CHAPTER 10
CONTROL SYSTEMS AND REGULATORS

10-1. Energizing and brightness control

The control systems and regulators for Army airfields and heliports will consist of properly rated regulators having a constant current output to the lights, and a control system to energize, deenergize and control the brightness (intensity) of the lighting systems (figs 2-2 and 3-1). Medium intensity lighting systems and high intensity lighting systems for short runways and the lighting systems for heliports will be 6.6-ampere series. High intensity lighting systems for long runways will be as in AFM 88-14. The lighting system for helipads, whether at airfields, heliports, or independently located, will normally be 120-volts, single phase, 60 hertz multiple circuits, as described below. Operational safety requires that the air traffic controllers he able to energize, deenergize, change brightness, and switch the various aviation lighting circuits instantly as required by the dictates of the operation of the moment. It is essential that the controls in the tower be maintained at all times. Control of aviation lighting is accomplished by the specifically designed combinations of circuit breakers, single pole switches, and single and multistage rotary switches, all mounted on a frame-work control panel, circuited in such manner that the lighting system may be energized from a remote station, as conditions demand.

10-2. Lighting system control points

At Army airfields and heliports there normally will be two points of control for the lighting system. The primary point of control will be in the operations room of the control tower. The alternate (secondary) point of control will be located in the equipment vault unless specifically directed or approved for location elsewhere. A single pole, single throw, key operated switch will be provided in the vault adjacent to the control panel for switching of the control circuits from the tower to the vault and vice versa through the transfer relay cabinet. When a helipad is located at an Army airfield or heliport, and located so that control from the tower is feasible, the primary location of the control panel should be the control tower. The alternate location will be the vault or structure housing the circuits to the helipad lighting system. Where the helipad is remote from the control tower, or located at a separate location where there is no control tower, the controls may be in the structure convenient to the helipad which houses the circuits to the helipad lighting system, a building remote from the helipad, or both locations.

10-3. Airfield control tower

When a new control tower is constructed it may be constructed as part of a hangar or other approved structure, or may be an independent structure. The entire airfield or heliport lighting system will be controlled from the control tower. Construction of a new control tower at an existing airfield or heliport will require the installation of a new control panel in the new control tower and the transfer of controls from the existing control tower or other point of control to the new control tower. All existing equipment in the existing control location will be salvaged. At installations where both an Army airfield and an Army heliport are to be constructed, a combination airfield heliport control tower may be constructed if considered practicable, provided suitable separate space and location of control equipment for each facility will be maintained and proper vision for control of both facilities is also available. Design of the control tower will be in accordance with the applicable requirements of DA Technical Bulletin, TB 95-1. Where a helipad is constructed at an Army airfield or heliport, the controls for the helipad should be located, if feasible, in the control tower. If the control tower houses control panels for airfield, heliport, or helipad, runways and taxiways, or any combination of the three, the panels should be physically separated in the tower so that the controller will not operate the incorrect control inadvertently.

10-4. Lighting control panels and relays

The following requirements apply to control equipment at airfields, heliports, and helipads.

a. Airfields and heliports.

(1) Control panel. The standard method for controlling an Army airfield or Army heliport lighting system for runways, taxiways, approach lighting where authorized, and auxiliary lights will be by means of a control panel conforming to Mil. Spec. MIL-P-8944. This type of panel will be located in the control tower as the primary control location and in the vault as the alternate location, unless another location is directed or authorized as the alternate location. The control switches for all of the airfield or heliport lighting systems will be mounted in this control panel. Where the control tower is for a combination airfield and heliport, two control panels will be installed, one for each lighting system.

(2) Transfer of control point of airfield and heliport lighting systems. The transfer of the control point of the airfield or heliport lighting system from the control tower to the alternate location will be by use of 8-pole, double throw transfer relay assemblies. Each assembly will be designated "Cabinet and Relay Assembly-Transfer Relay," Item No.409, conforming to Mil. Spec. MIL-P-4971. The number of these assemblies required for the system will be determined by the number of control cables from the control tower to the Cabinet and Relay Assembly-Transfer Relay.

This assembly will be located in the vault; where more than one unit is required, all of the 110-volt coils will be connected in parallel.

(3) Pilot relay equipment. A system utilizing low burden pilot relays is used because of the distance between vault and control tower at many Army airfield and heliport installations. In this type of system, switches on the control panel actuate low burden relays which in turn actuate power switches, contactors, and relays controlling the regulators and transformers supplying airfield and heliport lighting circuits. The low burden relaying equipment is contained in the "Cabinet and Relay Assembly-Pilot Relay," Item No.406, conforming to Mil. Spec. MIL-P-8945. This equipment will be wall mounted in the equipment vault and used to supply primary power to the low voltage and low wattage equipment and/or the primary control current for the larger pieces of electrical equipment.

(4) Wiring diagrams and circuiting. For additional information such as wiring diagrams and circuiting for the equipment described above, see AFM 88-14.

(5) Limitations or restrictions on use of control panels. Control panels will not be used to control older type regulators manufactured under the provisions of Army-Navy Specification AN-R-17, due to elimination of the push to turn feature from the rotary switches. The control panel is not intended to be a replacement item of equipment, and will not be installed where control panels conforming to Army Navy Specification AN-P-59 are already on hand. When a control panel is already in place in an existing control tower, and a new control panel will be installed at an alternate control point, the new panel will be installed in the control tower. The existing control panel (s) will be reinstalled at the alternate control point. When control panels already in place in an existing control tower and at an alternate location(usually the vault) at an Army airfield or heliport installation are in good operating condition and not considered obsolete, the existing control panels should be reused, with the necessary connections made to accommodate new circuits or equipment wherever practicable. The control panel combines the control features of the Type II control panel, Item No. 157B-1, and the type N-1, taxiway control panel, Item No. 301.

(6) Control panel mounting. The control panel may be wall-mounted, bracket mounted or table mounted at the alternate source of control (usually the vault). In the control tower, the panel may be table mounted separately or, if approved, maybe used in connection with the VFR control console, similar and equal to Air Force Model CY-442/CRC, where space is provided. The control console will not be installed as part of an Army airfield or heliport lighting system unless specifically directed or authorized. Where authorized or directed, the control console will be mounted in the control tower, and should be specified as furnished by the contractor. Mounting of the control panel chassis either (outer case removed) in the control console or table mounted, and the connections to the control panel, should be a part of the airfield or heliport lighting work. When appropriate for the standard method of wiring the control panel may be used to control two independent or intersecting runways and an approach lighting system.

b. Helipads.

(1) A control panel will be provided to house the applicable helipad lighting system controls, including the remote brightness controllers and, if required, the rotary switch for Landing Direction Light Bar selection. Controls for taxiway, taxilane, hoverlane, and auxiliary lights needed to control traffic to and from the helipad will also be housed in the helipad control panel, except where such lights are controlled from the airfield or heliport control panel. The helipad control panel should be mounted with a clearance separation from the airfield and/or heliport control panel, to prevent inadvertent operation of the wrong control panel by the panel operator. Construction of the helipad control panel should be similar to that of the control panel indicated above, and suitable for control of the helipad lighting system installed.

(2) Transfer of the control point of the helipad lighting system from the primary location to the alternate location will be by use of Cabinet and Relay Assembly-Transfer Relay, Item No.409 conforming to Mil. Spec. MIL-P-4971. These relays will be connected as described in 4a above.

(3) Landing direction lighting system relays will be housed in a metal cabinet similar to the housing for the other relay assemblies described above. The number of relays will correspond to the number of landing direction light bars installed at the helipad. These relays will be suitable for operation under load and will have two normally open contacts. One contact will energize the circuit for the selected landing direction light bar and the second contact will be the interlock permitting the approach direction lighting system, if installed, to be energized only when the landing direction lighting system is energized.

10-5. Runway lighting controls

The design of the runway lighting controls for airfields and heliports should assure that lighting on intersecting runways cannot be energized simultaneously. It should also insure that all the lights used for the runway will be energized simultaneously. The runway edge lights and the threshold lights are to be controlled to operate at the same brightness. The lights to be energized, and the brightness control of these lights, are controlled from the control panel and the related relay panels, through the regulator(s). The control of the high intensity runway lighting system is similar to that of the medium intensity runway lighting system. A miniature facsimile of the airfield or heliport runway(s) to be controlled will be mounted on the face of the control panel. The facsimile will be part of the taxiway facsimile described below. Insofar as practicable, the facsimile will be oriented with the airfield or heliport when viewed from the control operator's position.

10-6. Taxiway lighting controls

All taxiway lighting circuits will be controlled from the control panels in the control tower and in the vault. The taxiway portion of the control panel will be arranged so that the taxiway circuits can be operated independently. A miniature facsimile of the airfield or heliport, showing the layout of the runways and taxiways, should be either a scaled drawing or an aerial photograph. Each taxiway lighting switch should be installed on the facsimile near the center of the taxiing route for which the lighting is controlled. These switches will be singlepole, push-pull type, installed on the control panel as described in AFM 88-14.

a. Airfield taxiway control. Each taxiway circuit will be controlled by a switch mounted on the facsimile near the center of the taxiway circuit that it controls.

b. Heliport taxiway control. The control of the heliport taxiway lighting circuits will be as described in paragraph 3-5.

c. Helipad taxiway control. The helipad taxiway, taxilane, and hoverlane lighting systems will be controlled similar to such systems at airfields and heliports. When a helipad is at an airfield or heliport, lights on taxiways from helipad to the hangars and aprons, and to operations and parking areas should be controlled from the control tower by use of the control panel, if feasible. Where a helipad is in a remote location on an airport or heliport and the taxiways are of such length as to make a series circuit feasible, a separate control panel will be used for taxiway lighting control. This panel should be a regular product of the manufacturer making the control panel and should have the facsimile and control switches circuit breaker built into the panel. The panel should be similar in physical characteristics to the main control panel described above.

10-7. Auxiliary lighting controls

Control of obstruction lights, beacons, wind cones or tees, floodlights, and other lights performing similar functions should be obtained on the control panel or, in case of a remote helipad, from the control panel for the helipad lighting system.

10-8. Approach lighting controls

Approach lighting control at airports, heliports, and helipads should be installed only where approach lighting systems are specifically directed or authorized. Control at airfields and heliports will be from a control panel, and at helipads from the helipad lighting system control panel.

10-9. Grounding

All control panels and equipment will be electrically grounded in accordance with NFPA 70.

10-10. Control cables and terminations

The standard control cable is a seven conductor, 600-Volt, buna insulated, polychloroprene sheathed cable, item No.364, conforming to Mil. Spec. MIL-C-38359. One conductor (black) is a No.12 AWG and the remaining conductors of the cable are No.16 AWG. The No.12 AWG is used as the hot lead and the No.16 AWG conductors are used as switch legs. Where more than one 7/C control cable is used in a system, all of the No.12 AWG conductors should be connected together as one lead. Terminal blocks are to be used for terminating the control cables at the end of the underground run in the base of the control tower, and at the end in the equipment vault. Terminal blocks may be used at other locations for convenience of wiring and distribution. Commercially available junction boxes of the proper size equipped with compression-type terminal blocks will be used at all such terminations.

10-11. Lighting power supply and circuits

At airfields, runway lighting, approach lighting, and taxiway lighting systems will be supplied through series circuits served by constant current regulators, except for the MALS or MALSF, which will be sup-plied from a 120/240 volt, single phase, 60-hertz circuit. At heliports, the runway and taxiway lighting systems will be supplied through series circuits served by constant current regulators. At helipads the lighting system will be fed normally by 120-volt, single phase, 60-hertz circuits. Each part of the system will have its brightness controlled through a motor operated dimmer capable of withstanding the loads of the circuits to which it is connected. The taxiway, taxilane, and hoverlane lighting system normally will be supplied through series circuits served by constant current regulators.

10-12. Constant current regulators

The constant current regulators are designed for use on aviation facilities requiring series circuits for the lighting systems. Regulators, except those for taxiway systems at Army airfields, will have provisions for varying the output current from rated value to lower values so that brightness of the lamps in the lighting systems may be adjusted to suit visibility conditions.

a. Runway regulators. Each runway circuit will be served from a regulator designed to suit the system installed. The regulators considered as standard equipment are the packaged-type, containing necessary devices for protective relaying, on-off operation, 5-step brightness control, and line and load connections. Provisions are made in the regulators for local and remote control of the on-off operation and brightness control. The remote control points will normally be the control tower and the operators' room in the equip-

ment vault. The controllers will be as indicated above in this section.

(1) Medium intensity runway lighting regulators for airfields and heliports will normally be Type C-I, 4-kilowatt, single phase, 60-hertz, alternating current input, with primary taps at 190, 200, 210, 220, 230, and 240 volts. Rated secondary output is 6.6 amperes. A regulator conforming to FAA Advisory Circular AC 150/5345-10 will be used.

(2) High intensity runway lighting regulators normally will be type C-3 regulators as described immediately above. The number of lights that may he, placed on a circuit from this regulator is substantially less for a high intensity system than for a medium intensity system. Where a regulator requiring a 20 ampere output is to be used, the regulator will conform to FAA Advisory Circular *AC/150-5345,* having a single phase, 2,400 volts, 60-hertz, alternating current input with a rated output of 20 amperes. These regulators will have a 5-step brightness control.

b. Approach lighting regulators at airfields.

(1) The regulators for the high intensity approach lighting systems will be type C-3 as described above.

(2) The MALS or MALSF will not utilize regulators as described above. The power supply for this system of steady burning lights may be a variable output magnetic amplifier dimmer or a commercial transformer. The rating of either of the above will be 10 kilowatts, single-phase, 60-hertz. If the transformer is used, it should be connected to provide a minimum of two brightness steps to give 100 percent and approximately 10 percent of the steady burning lamp intensity. Ten percent of the steady burning intensity is obtained when the lamp voltage is 55 percent of rated value. The transformer will be tapped to provide the additional 5 percent of rated output voltage above the transformer center tap. The power supply for the sequenced flashing lights will be a transformer capable of supplying a minimum of 1.5 kW at rated current and voltage.

c. Taxiway regulators. Each taxiway circuit at airfields, heliports, and helipads *will* be served from a regulator-designed for a normal input voltage of 240 volts, provided with taps for input voltages of 210, 220, 230, 240, and 250 volts. The output will be constant at 6.6 amperes where brightness control is not a requirement. Where brightness control is a requirement, the regulator will be designed for a normal input voltage of 240 volts with taps at 190, 200, 210, 220, 230, and 240 volts. The output will have five steps of brightness control.

(1) Type M- 1 regulators will be 1.5 kilowatts, single phase, 240-volts, 60-hertz input, 6.6 amperes constant output, Item No.291, conforming to Mil. Spec. MIL-R-4707. The maximum number of 30-watt lights that may be connected to this regulator is 35.

(2) Type M-2 regulators will be 4.0 kilowatts, single phase, 240-volts, 60-hertz input, with 6.6 amperes constant output, conforming to FAA Advisory Circular AC 150/5345-10. The maximum number of 30-watt lights that may be connected to this regulator is 90.

(3) Where brightness control is used on taxiway lighting circuits, the regulators will be type C-I as described above.

(4) Where extremely long taxiways are to be lighted, it maybe necessary to use two taxiway circuits on a single taxiway section. The regulators for the taxiway circuits will be fed from branch circuit panelboards located in the equipment vault and controlled from the control panels as indicated above.

10-13. Helipad lighting system control components

The various components of the helipad lighting system, that is, the perimeter lights, landing direction lights, approach direction lights, helipad inset lights, and helipad floodlights, will be supplied through multiple circuits (figs 4-5 and 4-6). Intensity of lighting fixtures will be varied by use of dimmers. Dimmers will be located in the equipment vault, or in a structure convenient to the helipad when the helipad is remote from the vault, or no vault exists. The dimmers will be capable of controlling brightness from 0 to 100 percent intensity for the lights in different components of the overall system. The dimmers will be rated for 120-volt input, single phase, 60-hertz, with wattage ratings as required for the component of the system being controlled. The dimmer will be operated and the level of intensity adjusted by remote controllers. These controllers will be located in the control tower where the tower is used as the primary control location. Where the tower is so used, the vault or structure located near the helipad will be the alternate control location. The dimmers will have the capability of being preset to a specific value. The dimmers for the various components of the system are:

a. Perimeter lights. The perimeter lighting system consisting of 16 lights, will be controlled from a dimmer and brightness controller having a suitable kVA output for constant impedance load.

b. Landing direction lights. The landing direction-lighting system consists of one or two light bars having six lights per bar. The number of bars will be determined by the operation of the helipad. When used, these lights will be controlled from the perimeter lighting system dimmer, thereby increasing the output rating of that dimmer for a constant\ impedance load. The landing direction lights will be so circuited that only one light bar may be energized at any time, and only when the perimeter lighting system is energized.

c. Approach direction lights. The approach direction-lighting system will consist of 18 lights requiring a dimmer and controller with suitable output for a constant impedance load. The approach direction lighting system will be on a separate dimmer and controller, but interlocked with the landing direction lighting system so that the former is

operable only when one of the tight bars of the landing direction lighting system is energized.

d. Helipad inset lights. The helipad inset lighting system will be operated through a dimmer and controller independent of any other component of the helipad lighting system. The dimmer and controller will control a multiple circuit which feeds lights as described above and will have a suitable output for a constant impedance load.

e. Helipad floodlights. The helipad flood lighting system will be controlled by a dimmer and controller independent of any other component of the helipad lighting system. The dimmer and controller will be similar to others of the helipad lighting system except that the dimmer will be sized to suit the load required for the number of floodlights installed at the helipad.